

Shoreline prepared by authors from aerial and satellite imagery. Albers Equal Area map projection.

#### INTRODUCTION

The continental shelf of the northeastern Gulf of Alaska has sedimentation rates that may be the highest in the world ocean. This high rate is produced by an environment dominated by glaciation, a climate characterized by high precipitation, and an active tectonic regime dominated by uplift, factors that combine to furnish large quantities of sediment to the marine environment.

The continental shelf between Yakutat Bay and Prince William Sound, with an area of 35,365 km<sup>2</sup>, is covered with 1,418 km<sup>3</sup> of Holocene sediment. Maximum Holocene sediment thicknesses range between 225 and 350 m and many areas have thicknesses greater than 200 m (Carlson and Molnia, 1975). If uniformly distributed, Holocene sediment would cover the Yakutat Bay to Prince William Sound continental shelf to a thickness of 40.1 m.

Holocene sedimentation began between 10,000 and 15,000 yr B.P., following the retreat of the large ice-sheet that covered the entire continental shelf. No flexure age dates exist for the deglaciation of the continental shelf. Onshore dates range from 14,430 ± 800 yr B.P. (Sirkin and Tutthill, 1969) to 10,300 ± 350 yr B.P. and 10,620 ± 420 B.P. (Heusser, 1966). For purposes of calculation of sedimentation rates for this map, a 12,000 yr B.P. date is assumed for the onset of marine Holocene deposition.

#### SEDIMENTATION RATES FOR NORTHEASTERN GULF OF ALASKA EMBAYMENTS

Sedimentation rates for embayments are calculated from comparison of changes in bathymetry collected at known intervals and comparison of sediment thicknesses measured from seismic profiles showing positions of retreating glaciers (Molnia, 1979). The highest sedimentation rates in the map area is in upper Icy Bay, where sedimentation exceeds 2,000 m/yr. Here, where the bulk density of sediment averages 1.65 gm/cm<sup>3</sup>, the minimum sediment accumulation is 200 gm/cm<sup>2</sup>/yr. In lower Icy Bay, comparison of 1922 and 1976 bathymetry (Molnia, 1979) indicates maximum sediment-related depth changes of about 75 m, yielding a maximum sedimentation rate of about 1,400 m/yr for this time period. Lituya Bay, not shown on the map, but located 90 km east of Yakutat Bay has maximum sedimentation rates of about 5,700 m/yr (Molnia, 1979).

#### OFFSHORE SEDIMENTATION RATES

Offshore sedimentation rates were determined by dividing sediment thicknesses from a northeastern Gulf of Alaska sediment isopach map (Carlson and Molnia, 1975) by the assumed 12,000 years of deposition. The range of sedimentation rates calculated is 0 to more than 28 m/yr, the average rate 4.5 m/yr. One 10% sedimentation rate, the only isotope rate or age determined, indicates that sediment west of Kayak Island is accumulating at a rate of 7 - 9 m/yr. The calculated sedimentation rate for that area is between 6 and 9 m/yr.

Sedimentation rates greater than 28 m/yr exist adjacent to the mouth of the Copper River, the largest source of sediment in the northeastern Gulf of Alaska. Copper River sediment is transported westward into Prince William Sound between Montague and Hinchinbrook Islands. Sedimentation rates at the mouth of Prince William Sound exceed 18 m/yr. Other areas of high sedimentation are south of Icy Bay (> 20 m/yr) and south of Bering Glacier (> 14 m/yr), areas that receive large quantities of locally-produced glacial sediment.

The Tarr Bank area is devoid of Holocene sediment because of scour and erosion of fine material by strong bottom currents and storm waves. The shelf edge south and east of Kayak Island also is devoid of Holocene sediment. The southward expanding wedge of Holocene sediment will eventually cover this area if present sedimentation patterns and rates persist.

Cores collected south of Icy Bay had bulk densities that range from 1.58 gm/cm<sup>3</sup> to 1.74 gm/cm<sup>3</sup> (Carlson and others, 1979). Using the average bulk density of 1.65 gm/cm<sup>3</sup>, calculations indicate that sediment accumulation averages 0.73 gm/cm<sup>2</sup>/yr with a maximum of 4.74 gm/cm<sup>2</sup>/yr.

#### REFERENCES CITED

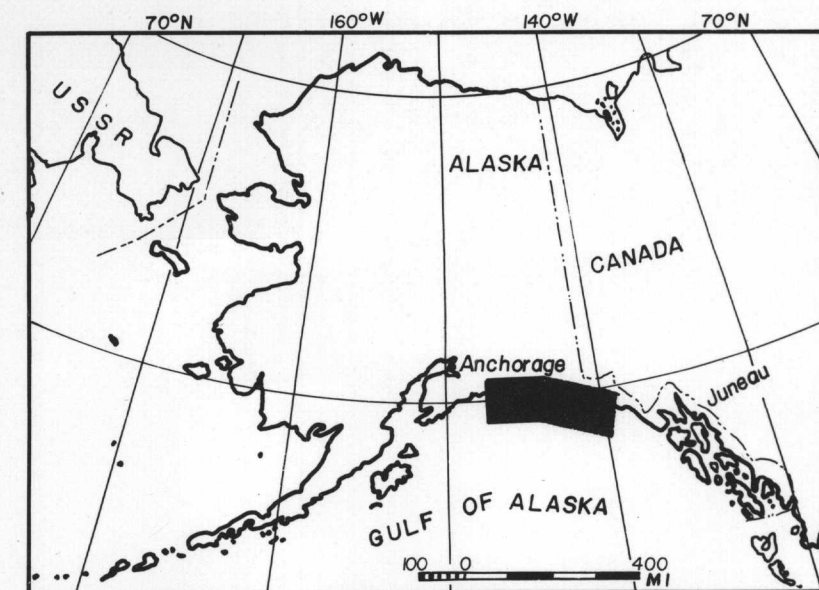
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#### EXPLANATION

Contours—Showing rate of sedimentation in millimeters per year (one meter per one thousand years). Contour interval 0-24, 2mm per year, > 24, 1mm per year. Dashed where approximately located

Rate of sedimentation in millimeters per year

<sup>210</sup>Pb sample locality



## MAP SHOWING HOLOCENE SEDIMENTATION RATES IN THE NORTHEASTERN GULF OF ALASKA

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